

ROYAL COMMISSION ON ARSENICAL POISONING.

FIRST REPORT

OF THE

ROYAL COMMISSION

APPOINTED TO INQUIRE INTO

ARSENICAL POISONING

FROM THE CONSUMPTION OF BEER AND OTHER ARTICLES
OF FOOD OR DRINK.

Part I.

R E P O R T.

Presented to both Houses of Parliament by Command of His Majesty.



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ARSENICAL POISONING

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THE ROYAL COMMISSION.

EDWARD, R.

Edward the Seventh by the Grace of God, of the United Kingdom of Great Britain and Ireland King, Defender of the Faith.

To Our Right Trusty and Well-beloved William, Baron Kelvin, Knight Grand Cross of the Royal Victorian Order; Our Right Trusty and Well-beloved Councillor Sir William Hart Dyke, Baronet; Our Trusty and Well-beloved Thomas Edward Thorpe, Esquire, Companion of Our Most Honourable Order of the Bath, Principal of the Government Laboratory; Our Trusty and Well-beloved Henry Cosmo Orme Bonsor, Esquire; Our Trusty and Well-beloved William Selby Church, Esquire, Doctor of Medicine, Fellow and President of the Royal College of Physicians of London; and Our Trusty and Well-beloved Benjamin Arthur Whitelegge, Esquire, Doctor of Medicine, Fellow of the Royal College of Physicians of London, Chief Inspector of Factories and Workshops, Greeting!

Whereas We have deemed it expedient that a Commission should forthwith issue to ascertain with respect to England and Wales;

(1) The amount of recent exceptional sickness and death attributable to poisoning by arsenic;

(2) Whether such exceptional sickness and death have been due to arsenic in beer or in other articles of food or drink, and, if so,

(a) to what extent;

(b) by what ingredients or in what manner the arsenic was conveyed; and

(c) in what way any such ingredients became arsenicated, and

(3) If it be found that exceptional sickness and death have been due to arsenic in beer or in other articles of food or drink, by what safeguards the introduction of arsenic therein can be prevented.

Now know ye, that We, reposing great trust and confidence in your knowledge and ability, have nominated, constituted and appointed, and do by these Presents nominate, constitute, and appoint you the said William, Baron Kelvin; Sir William Hart Dyke; Thomas Edward Thorpe; Henry Cosmo Orme Bonsor; William Selby Church and Benjamin Arthur Whitelegge to be our Commissioners for the purposes of the said Inquiry.

And for the better effecting the purposes of this Our Commission We do by these Presents give and grant unto you or any two or more of you, full power to call before you such persons as you shall judge likely

to afford you any information upon the subject of this Our Commission; and also to call for, have access to, and examine all such books, documents, registers and records as may afford you the fullest information on the subject; and to inquire of and concerning the premises by all other lawful ways and means whatsoever.

And We do by these presents authorise and empower you, or any two or more of you, to visit and personally inspect such places as you may deem it expedient so to inspect for the more effectual carrying out of the purposes aforesaid, and to employ such persons as you may think fit to assist you in conducting any Inquiry which you may hold.

And We do by these presents will and ordain that this Our Commission shall continue in full force and virtue, and that you Our said Commissioners, or any two or more of you, may from time to time proceed in the execution thereof and of every matter and thing therein contained although the same be not continued from time to time by adjournment.

And We do further ordain that you, or any two or more of you, have liberty to report your proceedings under this Our Commission from time to time if you shall judge it expedient so to do.

And Our further will and pleasure is that you do, with as little delay as possible, report to Us under your hands and seals, or under the hands and seals of any two or more of you, your opinion upon the matters herein submitted for your consideration.

And for the purpose of aiding you in your inquiries We hereby appoint Our Trusty and Well-beloved George Seaton Buchanan, Esquire, Doctor of Medicine, to be Secretary to this Our Commission.

Given at Our Court at Windsor the Fourth day of February 1901; in the first year of Our Reign.

By His Majesty's Command,

CHAS. T. RITCHIE.

NAMES OF WITNESSES.

- TATTERSALL, Charles H., Medical Officer of Health for the Borough of Salford.
- REYNOLDS, Ernest S., M.D., F.R.C.P., Assistant Physician to the Manchester Royal Infirmary; Visiting Medical Officer to the Manchester Workhouse Infirmary
- NIVEN, James, M.A., M.D., Medical Officer of Health for the City of Manchester.
- HOPE, Edward William, M.D., D.Sc., Medical Officer of Health for the City and Port of Liverpool; Professor of Public Health at the Victoria University.
- SALAMON, Alfred Gordon, Consulting and Analytical Chemist; Member of the Expert Committee of the Manchester Brewers' Association.
- GROVES, James Grimble, M.P., Chairman and Managing Director of Groves and Whitnall, Limited, Brewers, of Salford and Manchester.
- JONES, E. W. T., F.C.S., Public Analyst for the County of Stafford, and for the Boroughs of Wolverhampton, Walsall, Kidderminster, and Newcastle-under-Lyme.
- REID, George, M.D., C.M., Medical Officer of Health for the County of Stafford.
- STEVENSON, Thomas, M.D., F.R.C.P., Vice-President of the Chemical Society and of the Institute of Chemistry; Lecturer on Forensic Medicine at Guy's Hospital, London; Member of the Expert Committee of the Manchester Brewers' Association.
- TATHAM, John, M.A., M.D., Superintendent of Statistics, &c., Office of the Registrar-General.
- TUNNICLIFFE, Francis Whittaker, M.D., M.R.C.P., Professor of Materia Medica and Pharmacology at King's College, London.
- LUFF, Arthur Pearson, M.D., F.R.C.P., Physician in charge of out-patients at, and Lecturer on Medical Jurisprudence and Public Health at St. Mary's Hospital, London; Member of the Expert Committee of the Manchester Brewers' Association.
- TOMSON, Richard George Hooper, Manager of Threlfall's Brewery Company, Limited, Manchester.
- MILLER, Alexander K., Consulting Brewers' Chemist, Manchester.
- DIXON, Harold B., M.A., F.R.S., Professor of Chemistry at the Owens College, Manchester.
- KELYNACK, Theo. N., M.D., M.R.C.P., Medical Officer to the Pendleton Branch of the Salford Royal Hospital; Medical Registrar to the Manchester Royal Infirmary.
- KIRKBY, William, Pharmaceutical Chemist, Lecturer on Pharmacognosy at the Owens College, Manchester.
- MANN, John Dixon, M.D., F.R.C.P., Professor of Medical Jurisprudence and Toxicology at the Owens College, Manchester.
- DEAKIN, W. R., Brewer to the Manchester Brewery Company, Limited, Manchester.
- ESTCOURT, Charles, F.C.S., F.I.C., Public Analyst for the City of Manchester and for the Boroughs of Oldham, Macclesfield, &c.
- SERGEANT, Edward, M.R.C.S., L.R.C.P., Medical Officer of Health for the County of Lancashire.
- SCUDDER, Frank, F.C.S., Consulting Chemist, Manchester.
- BURY, Judson S., M.D., F.R.C.P., Physician to the Manchester Royal Infirmary.
- BELL, J. Carter, Public Analyst for the County of Chester and for the Boroughs of Salford, Birkenhead, &c.
- MORRIS, Herbert N., F.C.S., Chemical Manufacturer, Manchester.
- DELÉPINE, Sheridan, M.B., C.M., Professor of Pathology at the Owens College, Manchester,
- BLUNDELL, Henry Weld, Chairman of the Cornbrook Brewery Company, Limited, Manchester.
- COWELL, George E., Managing Director of Wilson's Brewery Company, Limited, Manchester.

- STEIN, Sigmund, Sugar Manufacturers' Chemist, Liverpool.
- MARSHALL, William, F.C.S., F.I.C., Public Analyst for the Borough of Hyde.
- SPENCER, Henry, Collector of Inland Revenue for the Manchester Collection.
- TAYLOR, Henry A., Messrs. H. A. and D. Taylor, Maltsters, Sawbridgeworth and Ware.
- O'SULLIVAN, Cornelius, F.R.S., Messrs. Bass, Radcliffe and Gretton, Limited, Burton-on-Trent.
- BRUNTON, Sir Lauder, M.D., F.R.C.P., F.R.S., Physician to St. Bartholomew's Hospital, London, Member of the Expert Committee of the Manchester Brewers' Association.
- GARTON, Richard Charles, Messrs. Garton, Hill and Company, Brewing Sugar Manufacturers, Battersea.
- RAW, Nathan, M.D., Medical Superintendent of the Mill Road Infirmary, Liverpool.
- DAVIS, Geo. E., F.I.C., Chemical Engineer, Consulting Chemist of the Manchester Technical Laboratory.
- PRIMROSE, Sir Henry W., K.C.B., C.S.I., Chairman of the Board of Inland Revenue.
- CAMPBELL-BROWN, James, D.Sc., Professor of Chemistry at University College, Liverpool; Head of the County and City Laboratory, Liverpool, and Public Analyst.
- LOVIBOND, Thomas Watson, F.I.C., Managing Director of the Newcastle Breweries, Limited.
- EARP, Thomas, Messrs. Gilstrap and Earp, Maltsters, Newark-on-Trent.
- BRIANT, Lawrence, F.C.S., Brewers' Analyst, representing the Chemical Manufacturing section of the Brewery Traders' Association, London.
- WILLIAMSON, Edward, late Secretary of Bostock and Company, Limited, of Garston and Liverpool.
- FRANCIS, E. G., Manager of the Manbré Saccharine Company, Limited, Fulham.
- WAHL, Rudolph Frederick, Managing Director, Nord-Deutsche Kartoffel-Mehl Fabrik, Cüstrin, Prussia.
- BERRY, Walter W., Hop Grower, Faversham.
- BAIRD, Hugh, Maltster, Glasgow.
- HOOPER, Egbert Grant, F.C.S., F.I.C., Analyst in the Government Laboratory.
- HEHNER, Otto, F.I.C., Public Analyst for the Counties of Nottingham, West Sussex, the Isle of Wight, and for the Boroughs of Derby and Ryde.
- READ, Clare Sewell, Representing the Central and Associated Chambers of Agriculture.
- STOPES, Henry, Representing the Central and Associated Chambers of Agriculture.

The following have submitted written statements to the Commission, but have not been examined thereon :—

- NICHOLSON, Joseph, Director of Nicholson and Sons, Limited, Chemical Manufacturers, Hunslet, Leeds.
- WILLIAMSON, Edward, late Secretary of Bostock and Company, Limited, Brewing Sugar Manufacturers, Garston and Liverpool.
- MORRIS, G. Harris, PH.D., F.C.S., F.I.C., Consulting Brewers' Chemist, London.
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REPORT OF THE COMMISSION ON ARSENICAL POISONING.

TO THE KING'S MOST EXCELLENT MAJESTY.

MAY IT PLEASE YOUR MAJESTY,

We, the undersigned Commissioners, appointed on February 4th last to inquire into the subject of arsenical poisoning, do humbly submit to your Majesty the following Report:—

We have now held 18 sittings in London and in Manchester, and we have examined fifty-one witnesses. The subject which your Majesty has referred to the Commission involves various administrative, scientific, and technical questions, which it is necessary for us to pursue further. We think, however, that a stage has been reached at which it is well for us to avail ourselves of your Majesty's gracious permission to report our proceedings from time to time, and to summarise in a first Report the conclusions at which we have arrived from the evidence already received. This we propose to do under the following heads:—

A.—The extent of recent exceptional sickness and death in England and Wales attributable to poisoning by arsenic.

B.—The causation of this recent epidemic of poisoning by beer which had become contaminated by arsenic.

C.—Certain medical and toxicological aspects of this epidemic.

D.—Arsenic in beer previous to this epidemic.

E.—Ways in which arsenic is liable to gain access to beer.

F.—Arsenic-free beer.

G.—Arsenic in articles of food and drink other than beer.

H.—Administrative considerations.

A.—*The extent of the recent exceptional sickness and death in England and Wales attributable to poisoning by arsenic.*

(1) During the latter part of 1900 there occurred in England and Wales exceptional sickness and death attributable to poisoning by arsenic. This sickness, which assumed epidemic proportions, has principally affected districts in Lancashire and Staffordshire, but its incidence has not been confined to those counties. The epidemic appears to have attacked Manchester and its neighbourhood more seriously than elsewhere. In the County Boroughs of Manchester and Salford alone the Medical Officers of Health estimate that at least 3,000 persons suffered by it.

(2) By inviting the co-operation of Medical Officers of Health throughout the country, by seeking information from the Statistical Department of the Office of the Registrar General, and in other ways, the Commission has taken steps to obtain information as to the extent, local distribution, and fatality of this exceptional sickness.

B.—*The causation of the recent epidemic of arsenical poisoning.*

(3) The evidence which we have received from physicians, medical officers of health, and others, has been uniformly to the effect that this epidemic sickness and death was attributable to beer which had become contaminated with arsenic at numerous breweries; that when, at the end of November, 1900, arsenic was indicated by Dr. E. S. Reynolds, of Manchester, as the cause of the epidemic in that city, beer from these breweries

was tested in a large number of instances, and arsenic was detected in dangerous proportions; that on the discovery of arsenic, steps were immediately taken by brewers and by sanitary authorities to ensure that this arsenical beer was withdrawn from sale; that this was done, usually with commendable rapidity, in all the districts from which we have received evidence, and that, as a result, the epidemic came speedily to an end.

(4) The evidence which we have received from Medical Officers of Health and others has shown that in all instances where this epidemic of sickness has been traced to beer from particular breweries, the latter have been users of brewing sugars supplied by a single firm, Bostock and Co., Limited, of Garston, near Liverpool. We use the term "brewing sugars" in this connection to comprise the two substances glucose and "invert sugar," which are extensively used in breweries as adjuncts to or as partial substitutes for malt, and as "priming" solutions which are added after the fermentation of the wort.

The quantity of arsenic detected in specimens of the above mentioned brewing sugars, by chemists who have given evidence to the Commission, has been relatively large.

In samples of Bostock glucose taken from breweries last November arsenic, as arsenious oxide, has been estimated as follows:—By Professor Delépine, of Owens College, Manchester, in several samples, from .015 per cent. to .095 per cent. (1.05 to 6.6 grs. per lb.) by Mr. E. W. T. Jones, Public Analyst of Staffordshire, in a single sample, .023 per cent. (or 1.6 grs. per lb.); by Professor Campbell Brown, of University College, Liverpool, in several samples, from .008 to .131 per cent. (.56 to 9.17 grs. per lb.).

Samples of Bostock glucose which had been obtained from breweries for purposes of Excise between June and September 1900, have been found at the Government Laboratory to contain from .013 per cent. (.89 grains per lb.) to .047 per cent. (3.28 grains per lb.).

With regard to Bostock invert sugar, samples taken from breweries last November have been found to contain arsenious oxide to the extent of .02 per cent. (1.4 grains per lb.) by Professor Delépine, and .062 per cent. (4.34 grains per lb.) by Professor Campbell Brown.

Samples of Bostock invert sugar obtained from breweries between September and December have been found at the Government Laboratory to contain from .024 per cent. (1.66 grains per lb.) to .046 per cent. (3.21 grains per lb.).

(5) The implicated Bostock brewing sugars became thus seriously contaminated by arsenic in course of their manufacture through the use of sulphuric acid supplied by a single firm of acid makers, Nicholson and Sons, Limited, of Leeds.

The amount of arsenic which has been estimated by witnesses to the Commission in specimens of Nicholson acid taken from Bostock's works in November was exceptionally high. In one such specimen Professor Harold Dixon, of Owens College, Manchester, estimated the arsenious oxide at 1.5 per cent.; in another specimen, Dr. Stevenson, of Guy's Hospital, estimated 1.4 per cent.; in five additional specimens, Professor Campbell Brown estimated amounts between 1.92 per cent. and 2.6 per cent. of arsenious oxide.

(6) We have had before us representatives of Bostock and Co. and of Nicholson and Sons, who in each instance have furnished us with a statement of the position of their firm in this matter. From these statements we understand that it is admitted by Messrs. Nicholson that from February to November, 1900, they supplied Messrs. Bostock with acid that must have contained arsenic; that Messrs. Nicholson did not inform Messrs. Bostock of the fact that the acid supplied by them during this period must needs have been arsenical, and they state that they did not know the purpose for which it was required. Further, we gather that Messrs. Bostock, who had been customers of Messrs. Nicholson for several years, appear to have systematically used the arsenical acid supplied to them from February to November, 1900, by Messrs. Nicholson in the preparation of brewing sugars without attempting to ascertain whether or not the acid contained arsenic, being under the impression that they were regularly receiving a pure acid made from brimstone.

(7) The firm of Bostock and Co. is now in liquidation, and an action for damages has been commenced by the Official Liquidators, on behalf of the creditors of that company, against the firm of Nicholson and Sons. Having regard to the terms of our reference, and also to the fact that the transactions between these firms are about to come before a court of law, we have not sought by pursuing inquiry into this matter to apportion between these two firms, or between individuals, the responsibility for the acts of omission or commission which have entailed serious sickness and loss of life to so many of your Majesty's subjects.

(8) So far as the Commission has at present learned, the proportion of glucose and invert sugar used in the production of the beers which were associated with the epidemic, was as a general rule no greater than those which are used in many other English breweries. And mischief appears to have been caused by some beers in which Bostock products constituted only a portion of the total brewing sugars used in their preparation.

(9) The amount of arsenic present in beers brewed with arsenical Bostock sugars must have varied widely at different breweries and in different kinds of beer. Not only did the proportion of these sugars used in different brews vary greatly, but there is further material difference due to the stage at which the sugar was introduced into the beer. The evidence goes to show that in the process of brewing a portion of the arsenic contained in arsenical brewing sugar added before fermentation will be removed by the action of yeast, and possibly also in other ways; whereas, if arsenical sugars are introduced as "priming," after the beer has left the fermenting vessels, the whole of the arsenic present in the "priming" solution will apparently remain in the beer.

(10) The quantities of arsenic reported to the Commission as having been found in specimens of beer brewed with Bostock sugar has been, in exceptional cases, as high as about $1\frac{1}{2}$ grains per gallon, and in one sample no less than 3 grains per gallon have been detected. As a rule, however, the proportion of arsenic in beers presumably associated with the production of the epidemic has been estimated at a lower figure, *e.g.*, 1 to $\frac{1}{2}$ to $\frac{1}{4}$ of a grain per gallon, or less.

Conclusion as to the exact amount of arsenic present in the inculpatated beers is rendered difficult by the fact that different analysts have employed different methods which in some instances have produced very divergent results when applied to samples of the same beer. We propose to make further inquiry into the relative value of different quantitative tests for arsenic in beer, as to the most trustworthy methods to recover all the arsenic present in a given sample of beer, and as to the possible existence of arsenic in beer in some combination with organic matter in which it might escape determination by certain of the tests commonly employed.

(11) It has been stated to us by one witness, Dr. Tunnicliffe, that he has detected a relatively considerable quantity of selenium in a sample of Nicholson acid—not, however, coming from Bostock's—in a sample of Bostock glucose, and in a sample of beer which had been manufactured with Bostock brewing sugars. This circumstance, taken along with the suggestion which he obtained from the toxic effect of selenium upon lower animals, led Dr. Tunnicliffe to infer that poisoning by selenium as well as by arsenic might have been an important factor in the epidemic.

We have, however, received no confirmatory evidence that selenium has been present in Nicholson's acid as supplied to Messrs. Bostock in any quantity approaching that determined by Dr. Tunnicliffe. We have received no confirmatory evidence of the detection of selenium in samples of Bostock brewing sugars, or of Bostock-brewed beer; on the contrary, the absence of selenium from these substances has apparently been proved in a considerable number of instances. On this subject we have evidence that since this suggestion by Dr. Tunnicliffe, search has been made for selenium in many samples of beer and brewing ingredients which had no relation with Bostock sugars, but in no case has selenium been found.

C.—*Medical and Toxicological Aspects of the epidemic.*

(12) The persons who have suffered by the epidemic in many instances have been ascertained to be heavy drinkers of beer. Nevertheless it is clear that others have suffered who probably drank quite moderate amounts of beer which there is no reason to believe was more arsenical than that which produced illness in heavy drinkers.

In this connection we have received reports of researches as to the presence of arsenic in excretions of sufferers by the epidemic, in their skin and hair, and in their organs post-mortem, which have been important as constituting additions to medical knowledge of the affinity which certain tissues of the body apparently possess for arsenic, and which indicate that in certain conditions the elimination of arsenic may take place more slowly than has been hitherto generally supposed.

(13) In our opinion the evidence obtained with regard to the epidemic suggests caution as necessary in comparing the effect of arsenic in small quantities taken at irregular intervals along with beer and in uncertain relation to food, with the effect of its medicinal administration under medical supervision.

(14) It is necessary to draw attention to this further circumstance. Among the beer drinkers attacked by the epidemic were many whose symptoms were hardly, if at all, to be distinguished from those of the disease known as "alcoholic peripheral neuritis," which hitherto it has been customary to associate with the consumption of large quantities of alcohol by spirit drinkers. Yet the persons attacked with disease closely simulating alcoholic peripheral neuritis were not in all cases heavy drinkers, nor was there reason to doubt that in their case arsenic in beer had been the essential cause of the illness.

We have been informed by certain physicians in Manchester and Salford that from their local experience of alcoholic peripheral neuritis, they had before the 1900 epidemic come to regard this disease as essentially one which affected beer drinkers. In this connection, too, the evidence suggests that in Manchester and Salford, for some years before 1900, "alcoholic peripheral neuritis" has been more common than in large towns in other parts of the country where, so far as is known, excessive drinking is no less common than in Manchester. We hope to obtain further facts with regard to this suggestion.

D.—*Arsenic in Beer previous to the epidemic.*

(15) Although the liability of beer to contain arsenic was not recognised before the epidemic, we cannot doubt that beer other than that brewed with the contaminated Bostock's brewing sugars of 1900, has in the past contained arsenic.

Since the epidemic arsenic has been estimated, occasionally in quantities such as $\frac{1}{10}$ grain per gallon, and frequently in smaller amounts such as $\frac{1}{100}$ to $\frac{1}{1000}$ grain, in the case of beers coming from certain breweries where Bostock's ingredients had not been used.

E.—*Ways in which Arsenic is liable to gain access to Beer.*

(16) We have received evidence that arsenic may be introduced into beer:—

(a) *By way of brewing sugars.*—The epidemic has clearly demonstrated that if the mineral acid employed in the manufacture of glucose from starch, or of "invert sugar" from cane sugar, has been arsenical, beer prepared from these ingredients can become dangerously contaminated by arsenic.

We have received no evidence which suggests that in the manufacture of brewing sugars other firms have permitted such a degree of risk as that which led to disaster in the case of Bostock and Co.; on the contrary, important firms of brewing sugar makers have testified that it has been their custom for many years past to take precautions to obtain a pure acid, and to test their acid for arsenic.

A large number of samples of brewing sugars of home and foreign manufacture—not from Bostock's—which were on the market before the discovery of the cause of the epidemic, have been examined by different analysts, and they nearly always have been found free from arsenic. In a few exceptional cases arsenic has been found, although in relatively small amounts. These exceptional cases include a sample of glucose which was found at the Government Laboratory to contain '09 of a grain of arsenious oxide per pound, and single samples of glucose or invert sugar in which arsenic has been detected by Professor Delépine, Mr. Gordon Salamon, and Professor Campbell Brown. Arsenic has been detected by three analysts in three separate samples of imported German glucose.

We have also received evidence of the presence of arsenic in specimens of caramel not coming from Messrs. Bostock.

(b) *By way of malt.*—In the British system of malting, the grain is exposed to the products of combustion of the fuel when on the kiln. We are satisfied that by use of fuel containing arsenic material quantities of arsenic may be deposited on malt and so reach beer.

(c) *In other ways.*—Other ingredients of beer, such as chemical substances used for various purposes, are liable from their mode of preparation to contain arsenic, and we have found that minute quantities have been in some instances introduced in this way.

(17) We are of opinion that access of arsenic to beer by means of these ingredients is avoidable.

(18) As regards brewing sugars and other ingredients where the source of risk is mineral acid, such as sulphuric acid, we have evidence that such acid can be obtained as a commercial article free from arsenic. It is quite practicable for manufacturers so to test every consignment as to insure the uniform freedom from arsenic of the acid which they use, and also, as a further check, to seek systematically for arsenic in their finished products. We have reason to believe that stringent precautions in these respects have now been adopted by British manufacturers of brewing sugars, and have suggested below administrative measures to secure that brewing glucose and invert sugar, of whatever origin, should be uniformly free from arsenic.

(19) More knowledge of the liability of fuels suitable for malting to contain arsenic is needed, and concerning this point, and the Government Department upon whom responsibility for the protection of the consumer from risk in this respect should ultimately rest, we propose to receive further evidence. Meanwhile we have reason to believe that this subject is being studied by maltsters with the view to adoption of the most suitable precautions to avoid risk of the access of arsenic to their malt.

If malt be dried by hot air, for example in cylinders or on kilns with impervious floors, the products of combustion do not reach the grain at any stage, and no risk of arsenic passing from fuel to malt is run. We have, however, had evidence from maltsters that they regard attempts to employ hot air in place of the fumes of the fire as commercially impracticable, not merely because of the large expense which would be entailed in reconstructing their kilns, and from the difficulty anticipated in suitably regulating the temperature and dissemination of the heated air, but also because they imagine that the products of combustion of fuel are necessary to give to malt a flavour which is needed to produce beer which is satisfactory to the consumer. We have not, however, received any experimental evidence tending to support this last contention.

We are of opinion that the use in the malting kiln of fuel selected on account of its freedom from arsenic, supplemented by a careful process of screening, brushing, and cleansing of the malt, will insure the protection of the public from danger due to the presence of arsenic in malt.

(20) As regards ingredients of beer other than brewing sugars and malt which are liable from their mode of preparation to contain arsenic, we are satisfied that by the exercise of care in the selection of these materials no risk of introduction of arsenic into the beer need arise.

(21) We have learned that search for arsenic has been made in a large number of samples of hops. In nearly every case they have been found free from arsenic, but in rare instances very minute amounts of arsenic have been detected. As hops on the kiln are exposed to the products of combustion of the fuel, it is desirable that the hop drier should exercise care in the selection of the fuel which he uses.

F.—*Arsenic-free Beer.*

(22) In our view the facts of the recent epidemic indicate that the presence of minute quantities of arsenic in beer should not be disregarded from the view-point of public health. It is not only essential to prevent gross contamination by arsenic such as occurred by the use of Bostock brewing sugars in 1900, but also it is desirable and practicable to obviate the access of arsenic to beer even in minute amount by way of any of its ingredients and thus to produce arsenic-free beer. We are satisfied from the evidence that since the epidemic precautions in this direction have been very generally adopted by brewers and others.

(23) It may be objected that it is hardly practicable to produce beer that can correctly be termed "arsenic-free" on the grounds that arsenic is a widely distributed element, that some tests for it are very delicate, and that any beer, however carefully prepared, would, if examined in sufficient quantity, be liable to show minute traces of arsenic.

That there is some force in this objection may be admitted. But in the absence of fuller knowledge than is at present available as to the possible effect of consumption of mere traces of arsenic, we are not prepared to allow that it would be right to declare any quantity of arsenic, however small, as admissible in beer or in any food, and we think it should be the aim of the manufacturer to exclude arsenic altogether.

As regards beer, we recognise the desirability of ultimately defining, in terms of a standard quantity of beer and of a standard test, a proportion of arsenic to be regarded as altogether inadmissible, so that there should be no cause for hesitation on the part of the public authorities or of the brewer in taking steps to prevent beer which transgresses this standard from being consumed by the public. To this extent the desired "freedom from arsenic" may be defined for administrative purposes by a standard test.

We have evidence that at the present moment analysts are by no means agreed as to the most efficient test to detect minute quantities of arsenic in beer. In view of these circumstances we consider it essential to institute further inquiry before recommending the standard test which should be imposed.

G.—*Arsenic in Articles of Food and Drink other than Beer.*

(24) We have received no evidence tending to show that articles of food or drink other than beer have been concerned in the recent epidemic. We have received information from analysts who have lately examined certain articles and ingredients of food and drink for arsenic, and have learnt that the results of these examinations have on the whole been negative. In instances which have so far come before us where arsenic has been detected, the amounts reported have been minute, and have not seemed to indicate material danger to public health.

(25) In our opinion, however, it would be unwise to assume that particular articles of food are free from risk of arsenical contamination because certain samples examined at a particular time have been found free from arsenic. In view of the circumstances associated with the recent epidemic, it is clearly necessary also to know whether or not in the case of a given article of food there is risk of access of arsenic owing to lack of knowledge or of care on the part of the manufacturer, and to determine the extent of risk in the absence of suitable precaution. By inviting the co-operation of public analysts throughout the country and in other ways we are taking steps to obtain further information upon this subject.

H.—Administrative considerations.

(26) In pursuance of the last paragraph of our reference, we have sought to ascertain how far the recurrence of such a catastrophe as the epidemic of 1900 may be avoided in future through the action of existing authorities :—

(a) Under the sale of Food and Drugs Acts, by the County or Borough Councils who are the authorities under those Acts, or by their public analysts ;

(b) Under the Public Health Acts, by Town Councils or Urban and Rural District Councils, or by their medical officers of health ;

(c) Under the Revenue Acts, which it is obvious can in any case afford security only as regards articles subject to duty, by officers of the Revenue.

With regard to the above-mentioned Acts and authorities we think it well to draw attention to the following points which have come before us in investigating the circumstances of the recent epidemic :—

(27) (a) *Sale of Food and Drugs Acts.*—We have heard of no instances in which samples of brewing sugar have been collected for public analysis under these Acts. After the epidemic public analysts did indeed in some cases obtain samples from breweries informally, but officers under the Sale of Food and Drugs Acts appear to have no statutory powers to collect samples of brewing sugars either from the factory or from the brewery.

Similarly, in the case of beer no samples have been collected for public analysis from breweries. Officers under the Acts possess power to obtain samples only when the beer is actually on sale. In practice authorities under the Sale of Food and Drugs Acts appear to have found that they possess no effective powers as against the sugar manufacturer or as against the brewer, and they have been obliged to institute proceedings against the retailer.

(28) We have learnt that, until the epidemic occurred, neither the public analysts nor others concerned were aware of the liability of beer to contain arsenic, and consequently they had applied no test to beer for its discovery.

It is not always recognised as a duty of a public analyst to advise his authority of the articles of food or drink which are liable to become contaminated with poisonous substances such as arsenic whilst in process of manufacture or in preparation for sale. For the most part his duty is understood to consist in analysing articles of food or drink sent to him officially under the Sale of Food and Drugs Acts, in order to ascertain if they are genuine and free from adulteration. The nature and number of such samples are not necessarily determined on the advice of the public analyst, but appear to depend upon a number of varying local circumstances largely outside his control. We are also informed that it is not the practice of any Government Department or other central body to do more than tender general advice to authorities under the Sale of Food and Drugs Acts concerning these matters.

(29) When the contamination of beer by arsenic became known, and public analysts had to examine large numbers of samples for arsenic and to express their results quantitatively, much uncertainty followed from the adoption of different methods and from lack of data by which to compare the divergent results obtained. Hence demand has arisen that some authority should prescribe standard tests for arsenic, which might be adopted or used for reference by all public analysts. It does not at present fall within the province of any public authority to formulate standard tests such as are demanded.

(30) (b) *Public Health Acts.*—We have heard of no instances in which official action under the Public Health Acts to obtain the seizure, condemnation, or destruction of arsenical brewing sugar on the premises of the sugar manufacturer or of the brewer has been considered practicable. Nor have we learnt of any case in which such action has been taken in respect of arsenical beer at a brewery. In the opinion of most of the witnesses whom

we have examined on this point, the provisions of the Public Health Act, 1875, and of the Public Health Acts Amendment Act, 1890, which enable officers of local authorities under certain conditions to obtain the condemnation and destruction of unsound articles of food, could not have been utilised for the above purposes.

We think it right to state, however, that we have evidence that informal action by medical officers of health, and steps which were taken by those who found their business implicated, sufficed to obviate much of the difficulty and risk which might otherwise have arisen through lack of statutory power in these respects.

(31) (c) *Revenue Acts*.—These Acts have hitherto afforded no power of inspection or control over the manufacture of brewing materials, and (unlike the Sale of Food and Drugs Acts, and the Public Health Acts) they have no application to articles of food and drink which are not subject to duty.

As regards breweries, it is not in practice accepted as part of the ordinary duty of officers of the Inland Revenue to acquire knowledge of the nature or origin of brewing materials to any further extent than may be necessary to safeguard the interests of the Revenue. Similarly, the function of the Government Laboratory, when dealing with samples of brewing materials sent to them by officers of Revenue for examination, has hitherto been rather the determination of their brewing value for purposes of preventing fraud on the Revenue, than of their quality or freedom from substances injurious to health.

(32) By the Customs and Inland Revenue Act of 1888, the Commissioners of the Treasury have been empowered to prohibit by publication of notice in the *London Gazette*, the use in the manufacture or preparation for sale of any article subject to a duty of excise, of “any substance or liquor of a noxious or detrimental nature,” or which, “being a chemical or artificial extract or product, may affect prejudicially the interests of the Revenue.” By the same Act a person using any substance thus prohibited in the manufacture or preparation for sale of any article specified in the published notice is subject to penalty. We have learned that in practice this provision has come to be generally regarded as one essentially designed to protect the Revenue. It has not been made altogether clear that the provision would cover the prohibition of arsenicated brewing materials. The only article which has been scheduled at the instance of the Board of Inland Revenue for exclusion from breweries has been saccharin, which has been so treated for Revenue reasons.

(33) On consideration of all the circumstances connected with the recent epidemic, we think that some improvement in administrative measures is called for. It is evident that amendments have to be considered, not only with reference to the question of arsenic in beer, but also in relation to the broader question of the machinery available to public health authorities to obviate risk of arsenic or other poisonous substance reaching articles of food and drink in general.

Upon this important general question we consider it essential to await further evidence before making final recommendations. But meanwhile, seeing that the epidemic of 1900 has been caused solely by beer, and that there exists in the case of breweries (although for another purpose) a system of close inspection by a Government Department—the Board of Inland Revenue—we think that as a provisional measure the machinery under this system might effectively be turned to account to check the introduction of arsenic into beer by way of its ingredients.

(34) To this end we recommend that the Board of Inland Revenue should possess and should exercise powers to specify in detail individual ingredients of beer which are liable from their origin or mode of preparation to be contaminated by arsenic, to prescribe for every such ingredient, and for the different materials used in their preparation, an adequate test which should ensure their freedom from arsenic, and to prohibit, under penalty, the use in a brewery of any material which infringes the prescribed test.

We are of opinion that by requiring the brewer to produce satisfactory evidence (whether in the form of a guarantee from the vendor, or as the result of analysis by the brewer's chemist, stated in such terms as the Board of Inland Revenue may determine) that the prescribed tests have been applied to all the ingredients of beer at the brewery which have been specified as liable to contain arsenic, and that by the examination of samples in the Government Laboratory, an immediate and effective safeguard to the public with regard to arsenic in beer can be secured.

All which we humbly submit for your Majesty's gracious consideration.

(Signed) KELVIN,
Chairman.

W. HART DYKE.

W. S. CHURCH.

T. E. THORPE.

H. COSMO BONSOR.

B. A. WHITELEGGE.

G. S. BUCHANAN,
Secretary.

6 July 1901.

MEMORANDUM BY DR. WHITELEGGE.

I concur in the Report except one portion of paragraph 34.

The excise officers visit breweries, and will in future habitually visit certain brewing sugar factories in this country, for revenue purposes. I concur fully in the recommendation that as regards those places, and all materials found there, they should utilise their opportunities of supervision with a view to secure freedom from arsenic, and that in order to make the control effective, the Board of Inland Revenue should possess and exercise power to prescribe and enforce a standard chemical test for any of the above materials that lend themselves to it. Samples could then be taken from bulk for official analysis; and indeed a check of this kind would seem to be essential for the purpose.

But the wide terms of the recommendation in paragraph 34 include more remote materials, not to be found in the brewery or the sugar factory, such, for example, as the fuel which has been used in malting. Whatever may ultimately prove to be the right course, I venture to think that at the present stage of the inquiry, and in a provisional recommendation, the reference of administration and standards to the Board of Inland Revenue should be limited to materials found upon the premises visited for revenue purposes.

In the instance I have given, unless the excise officers undertake the supervision of malting premises, they cannot see or sample the fuel in use there; and if reliance is to be placed upon their inspection at the brewery of certificates relating to fuel already consumed at the maltsters, the official control ceases to be effective, for the certificate cannot even be linked in any practical way with the fuel to which it relates.

And further, it remains to be determined by the Commission whether careful selection of fuel as regards its nature and origin, or subjection of it to some safeguarding process, would not afford to the maltster a surer basis of precaution than reliance upon certificates of compliance with a standard chemical test, the value of which in practice must depend upon the proper choice of samples taken from a large bulk of fuel. No evidence upon this point has yet been received, and the Commission, as stated in paragraph 19, propose to institute further inquiries.

In the circumstances, I cannot but regard this part of the recommendation in paragraph 34 as premature.

(signed) B. A. WHITELEGGE.

10 July 1901.